



# ***GNSS Timescale Description Template***

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# *Heading*



## **GNSS Timescale Description**

### **GPS**

### **Definition of System**

- Introductory text, defines the document, the name of the system and the header for the numbered questions



# *Basics*



## **1. System timescale: GPS Time**

## **2. Generation of system timescale:**

- Covers the basics:
  - The name of the system timescale
  - The generation of the timescale, which for GPS is a clock ensemble of various station and GPS clocks



# Steering



- **3. Is system timescale steered to a reference UTC timescale?**
  - **a. To which reference timescale:** UTC(USNO)
  - **b. Whole second offset from reference timescale?**  
Yes, 15 seconds ahead of UTC as of 07/2010, with changes corresponding to the addition/subtraction of leap seconds
  - **c. Maximum offset (modulo 1s) from reference timescale?**  
1 microsecond, typically within 10 nanoseconds
- Covers information on the steering of the GNSS Timescale to a reference laboratory timescale
- Includes statement of any offsets and maximum offset modulo one second
- GPS Time is steered to UTC (USNO)



# *From Satellite Time to System Time*



- **4. Corrections to convert from satellite to system timescale?**
  - a. Type of corrections given; include statement on relativistic corrections
  - b. Specified accuracy of corrections to system timescale
  - c. Location of corrections in broadcast messages
  - d. Equations to correct satellite timescale to system timescale
- This section covers the conversion of satellite timescale to system timescale.
- GPS almanac and ephemeris information is referenced to GPS Time, so this conversion is necessary.
- GPS includes a statement on the particular anomalies for which the given relativistic correction accounts and the given, typical accuracies.



# *From System Time to Reference UTC Time*



- **5. Corrections to convert from system to reference UTC timescale? If yes:**
  - a. Type of corrections given
  - b. Specified accuracy of corrections to reference timescale
  - c. Location of corrections in broadcast messages
  - d. Equations to correct system timescale to reference timescale
- This section concerns the conversion of GNSS system time to a reference UTC, and the accuracy associated with the conversion.
- GPS includes the equations to convert from GPS Time to UTC as realized by USNO, and the stated and typical accuracy.



# *Stability*



- **6. Specified stability of system timescale**  
Not specified
  - **7. Specified stability of reference timescale**  
UTC(USNO) stability of  $3 \times 10^{-15}$  per day
  - **8. Specified stability of satellite clocks**  
Not published, stability depends on block of satellite
- 
- These sections are about timescale stability.
  - GPS does not publish much information on this, other than the minimum stated stability of USNO.





# *System to GNSS Time Offset (GGTO)*



- **9. Availability of System to GNSS Time Offset (GGTO)**
  - a. Systems for which corrections are given?
  - b. Type of GGTO corrections given
  - c. Stated accuracy of GGTO correction, if available
  - d. Location of corrections in broadcast messages
  - e. Equations used for GGTO message
- GPS plans to broadcast GGTO corrections for up to 7 GNSS systems
- GPS has a stated goal of 5 ns (95%) for a GPS to Galileo time offset.
- Accuracies to other systems depend largely on **each system's time scale predictability.**



# *Additional Information*



- **Describe the details of the system, i.e. locations of system and reference timescale clocks, generation of timescales, and other details.**
- GPS includes information on the GPS Master Control Station location and more on the computation of GPS Time, among other topics.
- Also present is a section about the tuning of oscillator frequencies of the clocks onboard GPS Satellites to account for special and general relativistic effects to ground-based observers



# *Additional Information*



- **Describe how the timescale transfers from the reference timescale to the system timescale and finally to the satellites. Include the nominal rate of SV updates.**
- USNO monitors the offset of GPS Time to UTC as realized by USNO and reports this data to GPS Operations
- GPS satellites are nominally updated at least once per day



# *Additional Information*



- **If any other pertinent details exist concerning the generation and realization of system and/or reference time, include them as well.**
- GPS includes a statement on the signal types used to realize GPS time